A space-age house demonstrates how advanced technology can cut home fuel consumption by two-thirds and water usage by half, while providing bonuses in convenience and safety.

the house that NASA built

You are thinking of buying a home and, perhaps even more than the purchase price, you're concerned about the monthly outlay, the mortgage payment plus the utility bill. You know utility costs are climbing about 10 percent a year. Even water, once a small item in the homeowner's budget, is more expensive. In the not-too-distant future it's possible utility costs will exceed mortgage payments.

As a homeowner, how would you like to be relatively independent of rising utility costs, and draw instead on nature's bounty for a significant part of your energy needs? Or, to put it another way, how would you like a house whose special design and other features could save you over $20,000 in utility savings over a 20-year period and at the same time offer a variety of innovations that add up to greater comfort, convenience, security, and fire safety?

Such a house already exists. It's still in the demonstration stage, but all of its equipment and design features are now available to the public or will be within only a few years. Most of the systems evolved from some aspect of the space program. Each was selected to fit one of the guideline categories: money savings, safety, or comfort.

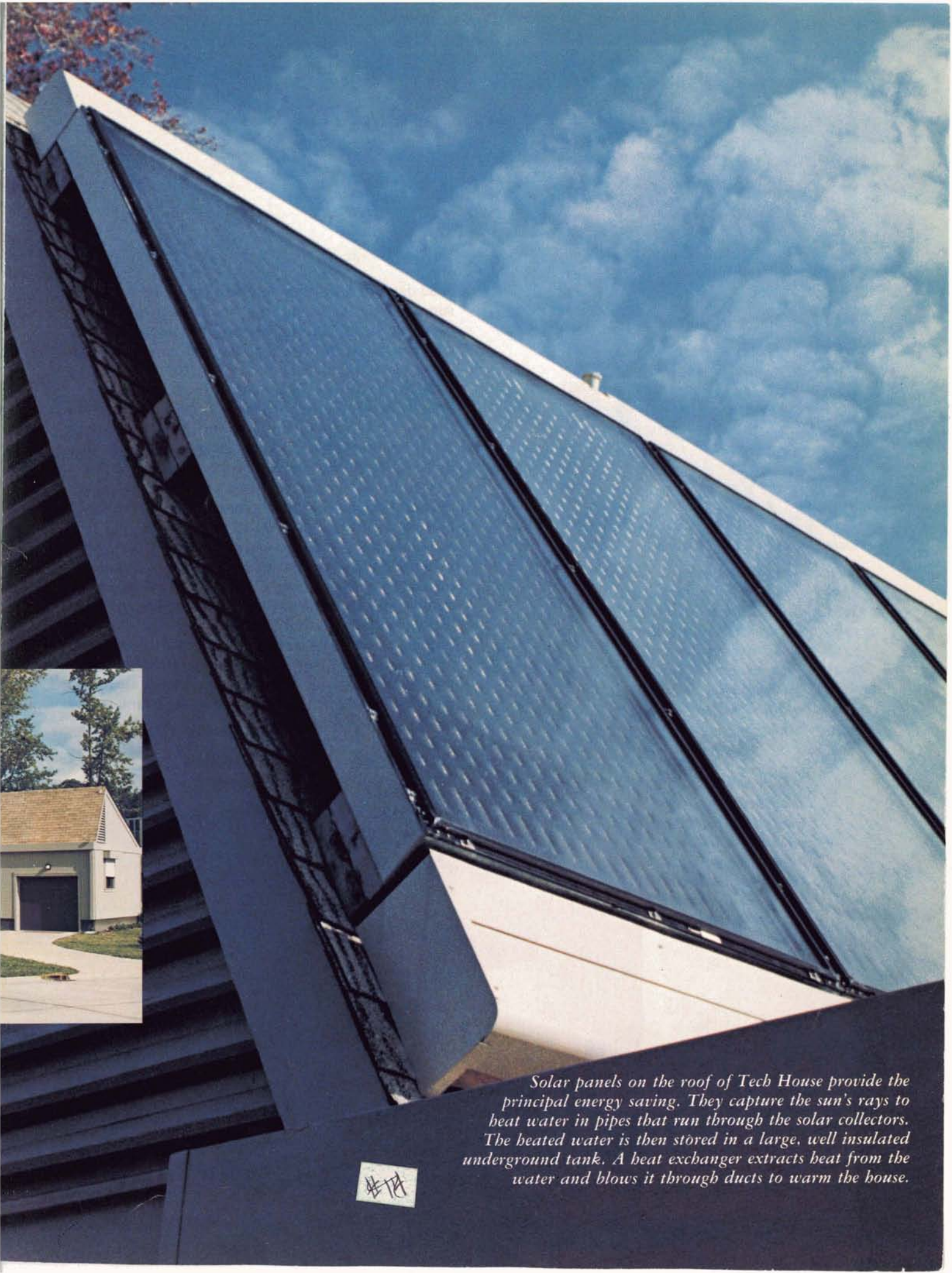
The home is called The Energy Conservation House (Tech) and it is located at NASA's Langley Research Center in Virginia. Tech House incorporates NASA technology, the latest commercial building techniques and other innovations, all integrated into a super-efficient home that offers exceptional savings to the individual family and potentially great national benefit in resource conservation.

Starting this year it is planned that a family will live in the home for a year while NASA engineers monitor the new systems and put together a record of day-to-day performance. NASA officials believe the Tech House concept may influence near-term developments in home construction by pointing up the many benefits space-age technology offers.

Tech House is a contemporary, one-story, three-bedroom home which could be available commercially within five years for $45,000 to $50,000 (in today's dollars), a price range once in the luxury class but now close to the average. It has a large living room with a fireplace, dining area, kitchen, three bedrooms, two baths, laundry and garage. Because energy-conserving homes must be tailored to specific sites, Tech House is not a prototype of a mass producible design suitable for all locations. Rather it is a research and development laboratory for testing innovations that can be applied to some degree in all housing.

The principal energy-saving comes from using the sun's rays to heat the home and provide domestic hot water. Sunlight is captured by 19 solar collectors on the roof. These south-facing collectors are angled

Tech House, located at NASA's Langley Research Center, Hampton, Virginia, is a demonstration project in which aerospace and commercial building technology are combined to produce an energy-efficient home. Advanced technology offers savings to the family in utility costs and energy conservation.



Solar panels on the roof of Tech House provide the principal energy saving. They capture the sun's rays to heat water in pipes that run through the solar collectors. The heated water is then stored in a large, well insulated underground tank. A heat exchanger extracts heat from the water and blows it through ducts to warm the house.

These two tanks make up a unique Tech House domestic hot water system. Water in one tank is "preheated" by solar energy, then fed into the other tank where a conventional electric heater further raises the temperature if necessary. Preheating takes care of 80 percent of the hot water energy requirement.

at 58 degrees for best exposure to the Virginia winter sun. (In other latitudes, they would be mounted at different angles; 21 degrees plus the latitude is optimum.) The individual solar collector has a glass outer plate and a metal inner plate, the latter coated with black chrome. The coating, developed in research on solar cells for spacecraft, prevents much of the heat from "reradiating," or escaping outward. Black chrome offers a 20 percent efficiency increase in the solar-collection process.

Running through the solar collectors are pipes through which water is circulated from a 2,000-gallon underground storage tank. The water is heated by the sun's rays to a temperature of 140 to 170 degrees. When the house needs heating, the hot water passes through a heat exchanger, which extracts the heat and blows it through ducts to warm the home. When heating is not required, the water bypasses the heat exchanger and goes directly to the tank for later use.

The system is largely independent of electrical energy, although an electric heat pump is also employed to transfer heat from the storage tank to the living space of the house.

Tech House is well insulated for energy savings. The principal insulation is fireproof Tripolymer foam which is sprayed onto walls and ceilings in thicknesses up to six inches.

For summer cooling, fans blow air cooled by water. The water is cooled by these radiators on the roof; at night, water from the underground storage tank is run through the radiators, heat is radiated out and cooled water delivered back to the tank.

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The storage tank was designed to hold enough heat for five days of operation during overcast periods. After that, the temperature of the stored water will fall below 110 degrees. At that point the heat pump automatically goes into action, elevating the temperature to the requisite level, drawing the water from the tank and sending it through the heat exchanger for heat transfer to the living area. The water then is routed back to the tank.

For cooling the house, the heat pump system operates in similar fashion, except that it uses cool water; the cooler the water, the more efficient the pump. Water cooling is accomplished by radiators on the roof. At night, water from the storage tank is run through the radiators, heat is radiated out, and cooled water delivered back to the tank.

For domestic hot water, Tech House employs a two-stage "preheating" method. Water in one tank is heated by solar energy, then fed into another tank where an electrical system provides additional heating if required to reach a preset temperature level. Preheating by solar energy generally takes care of 80 percent of the hot-water energy requirement.

Much of the home's energy saving potential stems from the fact that it is well insulated. The floor is a two-inch cast of prefabricated concrete insulated with noncombustible gypsum foam. Tripolymer foam ranging from three and a half to six inches thick insulates the walls and ceiling. An excellent insulator, Tripolymer is nonflammable, nontoxic, odor free, and rodent-resistant.

The outer doors are built sandwich-fashion, with a core of polyurethane foam between the metal facings. The core has four times the density of wood and it completely blocks out cold because there is no

contact between the inside and outside metal surfaces. Magnetic weather stripping, such as used in refrigerators, seals the doors.

Windows not only are double-paned for insulation but also incorporate thermal shutters. Although not products of space technology, the Venetian blind type shutters are rolled down by motor or crank to form an exterior window seal.

The efficacy of all these insulating measures is evident in this fact: in conventional construction it would take a two-ton air-conditioning unit to cool the 1,500 square feet of living area, but Tech House can be kept comfortable by a one-ton system. And the superior insulation also sharply reduces noise transmission from the outside and from room to room.

More Energy Savers

In addition to insulation, Tech House boasts a variety of other novel design features and systems to reduce energy usage.

Exterior design includes a larger than normal roof overhang on the south wall. In winter months, when heat gain is desirable, sunlight can penetrate the south-facing windows. In the summer, when the shutters are rolled up to admit light, the overhang protects the home from direct sunlight because of the sun's higher angle.

A large skylight, centrally located above the foyer, admits radiant energy from the sun in the winter, helping to heat the house. The skylight can be opened to create a chimney effect for ventilation. In either winter or summer, the skylight admits daylight to the foyer and living area, reducing the need for artificial light during daytime hours.

Except for a glass screen in front of it, the fireplace appears to be entirely conventional, but it is not. An ordinary fireplace draws air from the comparatively warm room, wasting heat. The Tech House fireplace derives combustion air from outside through ducts. Heat from the fireplace radiates into the living room through the glass screen, but the screen keeps room air from escaping. Additional heat is gained from a conventional double walled metal firebox.

The grate on which the burning logs rest is composed of pipes through which water is circulated. The fire-heated water is passed on to the storage tank as part of the overall heat-capture system. Where the ordinary fireplace yields only

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The large skylight over the foyer admits daylight to the living area, reducing the need for artificial light in daytime. It also admits radiant energy from the sun, assisting the solar collectors in heating the home, and serves as a ventilator.